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YIELD AND GRADES OF BLIGHT RESISTANT POTATOES GROWN* IN TWENTY DIFFERENT LOCATIONS IN NEW YORK STATE IN 1947

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Twenty varieties of potatoes were planted in 20 different locations, including Long Island and all of the important potato growing sections of upstate New York. Older 4-H Club boys were chosen as cooperators. The layout was a randomized Latin Square with each replication at a different location. Green Mountain, Katahdin and Rural varieties were used as standards. The remaining 17 varieties were blight-resistants developed by Dr. Donald Reddick of Cornell. Eight of the latter were named varieties and 9 were numbered seedlings.

All plantings were made during the latter half of the potato planting season in each area. On Long Island this period ranged from the 15th of April to the 20th and in upstate New York from the 10th of June to the 20th. It was planned to spray all plots with DDT only, so that blight resistance could be checked as well as the yield and other factors. However because of the inconvenience of not using copper in small section of the regular field, 4 plots did receive copper sprays. Four others received no spray whatever and in those plots, the varieties most susceptible to leafhopper injury, such as Chenango and Snow-

*Paper 300, Department of Vegetable Crops, Cornell University, Ithaca, N. Y.

drift, were killed early and yielded less than where protected against this injury.

All plots were harvested after frost had killed the plants, except on Long Island where they were all mature by digging time—the 23rd of September. Dry weather for eight weeks before frost in the upstate area caused the earliest and least hardy varieties to "mature" before frost.

At harvest, the number and weight of tubers were recorded. The tubers were sized into those over 2 inches and those under 2 inches in diameter. Those over 2 inches were divided into those that would pass the U. S. No. 1 grade standard and those that would not. Those that failed to make the No. 1 grade were divided into the following lots: (1) scabby; (2) misshapen and second growth; (3) sunburn, and (4) tuber rot.

Tubers injured only by insects or mechanical means were included with the No. 1's as these defects were considered unrelated to the genetic makeup of the variety. An analysis of variance of the data showed that all results were significant at the 1 per cent level.

The average yield of the 20 varieties on the 20 plots was 229 bushels of U. S. No. 1's and 337 bushels total per acre. On the total yield basis. 15 of the blight resistant varieties outyielded all three of the standard or blight-susceptible varieties. Fourteen of the 17 new blight-resistant varieties gave higher average yields of No. 1's than any of the 3 standards.

Of the standard varieties Katahdin had the highest yield of U. S. No. 1's over 2 inches—180 bushels per acre. This yield was exceeded by 14 of the 17 blight-resistant varieties and was exceeded by a difference significant at the 1 per cent level, by Essex, DUA-11, Ashworth, Placid. DZE-10, DUA-2, Virgil and DVA-10; and at the 5 per cent level by Chenango.

Green Mountain, the highest yielding of the standard varieties when compared on a total yield basis, was exceeded in total yield by 15 of the 17 blight-resistant varieties. This difference was significant at the 5 per cent level in the case of 8 varieties.

When compared on a basis of the weight of scabby potatoes, (table 1) Ashworth and Essex showed significantly more scab at the 1 per cent level than did CRF-3, DXM-3, EVI-2, FBY-1, Rural and Snowdrift, and also significantly more at the 5 per cent level than Chenango, DUA-2, DVA-10, Empire, Fillmore and Katahdin. When scabby tubers are compared on a count basis the picture is much the same except that only Essex has significantly more scab at the 1 per cent level than the least scabby varieties. As will be seen in table 2, this

TABLE I.—*Weighted yield per acre.*

Variety	Maturity	No. Locations Where Yield Was Better Than Green Mountain, Katahdin and Rural	Weighed Yield per Acre					
			Over 2"			Under 2"	Total	
			U. S. No. 1's		Scabby			
			Bu.	Rank	Bu.	Bu.	Bu.	Rank
Ashworth	Early	17	320	3	41	37	423	3
Chenango	Early	13	235	9	16	80	346	8
CRF_3	Late	12	223	11	14	40	297	14
DUA_2	Midseason	13	266	6	18	80	392	7
DUA_{11}	Midseason	18	320	2	23	58	458	2
DVA_{10}	Early	17	251	8	18	36	320	11
DXM_2	Midseason	8	137	20	7	75	242	19
DZE_{10}	Midseason	16	286	5	35	49	397	6
Empire	Late	12	207	12	17	35	281	15
Essex	Early	17	345	1	41	69	480	1
EVI_2	Late	9	161	18	13	94	306	13
FBY_1	Late	9	187	14	12	98	312	12
FIG_3	Midseason	8	178	17	25	98	321	10
Fillmore	Late	9	194	13	16	45	271	17
Green Mt.	Midseason	—	177	16	21	61	277	16
Katahdin	Midseason	—	180	15	16	49	269	18
Placid	Midseason	16	289	4	22	61	415	4
Rural	Late	—	138	19	7	63	213	20
Snowdrift	Early	11	218	10	12	76	322	9
Virgil	Midseason	15	266	7	20	70	402	5
Average			229		19.6	63.7	337	
LSD 1 per cent			62		29	27	85	
LSD 5 per cent			47		22	20	65	

TABLE 2.—*Number of potatoes per hill.*

Variety	Over 2"					Under 2"	Total	
	U. S. No. 1's		Scabby		Blight Rot			
			All Plots	*No. 6 Omitted				
	No.	Rank	No.	No.	No.	No.	No.	Rank
Ashworth	3.55	8	.46	.24	.066	1.67	6.04	13
Chenango	3.70	6	.26	.08	.068	3.72	8.00	5
CRF-3	2.97	13	.20	.07	.116	1.76	5.21	19
DUA-2	3.72	5	.26	.05	.046	3.82	8.21	3
DUA-11	4.17	2	.26	.02	.140	2.54	7.50	8
DVA-10	3.04	12	.22	.10	.104	1.71	5.32	17
DXM-3	2.45	17	.11	.04	.054	3.37	6.29	12
DZE-10	3.66	7	.42	.24	.034	2.25	6.72	11
Empire	2.62	15	.18	.01	.196	1.53	4.60	20
Essex	4.68	1	.54	.38	.030	3.48	9.03	1
EVI-2	2.34	19	.17	.07	.070	3.80	6.77	10
FBY-1	3.17	10	.17	.01	.106	4.55	8.02	4
FIG-3	3.12	11	.46	.24	.262	4.95	8.92	2
Fillmore	2.70	14	.22	.04	.040	2.12	5.24	18
Green Mt.	2.43	18	.32	.11	.226	2.84	5.89	14
Katahdin	2.59	16	.26	.08	.152	2.10	5.34	15½
Placid	3.76	3	.28	.05	.122	2.51	7.17	9
Rural	2.20	20	.12	.01	.060	2.96	5.34	15½
Snowdrift	3.52	9	.23	.10	.092	3.47	7.57	7
Virgil	3.74	4	.28	.08	.048	3.31	7.93	6
Average	3.21		.271	.1056	.1006	2.92	6.76	
LSD 1 per cent	1.16		.40	.23	.16	1.18	1.52	
LSD 5 per cent	.88		.30	.14	.12	.89	1.16	

*The figures are shown both with and without location No. 6, as in that location 77 per cent of all tubers over 2" were too scabby to pass the U. S. No. 1 grade. With plot No. 6 included, varietal differences were barely significant at the 1 per cent level, but without it they become much more significant.

difference became more significant when the figures were recalculated with location No. 6 omitted. (See footnote to table 2.) It should be understood that counts of scabby tubers were only an incidental part of the record taking and that no special effort was made to include scab-resistant varieties. Only one of the 20 locations (table 3) showed an amount of scab significantly above the average. There the 20 varieties averaged 258 bu. per acre with tubers too scabby to meet the U. S. No. 1 grade.

The number and weight of sunburned tubers were significantly above average in the case of Placid and Virgil. However, some locations were practically free from sunburn on all varieties, so it can probably be assumed that cultural practices could be modified to keep this defect low on these varieties. Katahdin, Essex and DUA—2 also had more than an average number and weight of sunburned tubers, though not by a significant amount.

One measure of the advantages gained by planting blight-resistant varieties is the increase in the average yield of all resistant varieties compared with that of all susceptible varieties. When based on the average yield at the 20 locations, this increase was 75 bushels per acre of No. 1 potatoes—240 bushels compared with 165 bushels and the increase amounted to 99 bushels per acre total yield—352 bushels as compared with 253 bushels. However, in the 8 locations where blight was not serious, the yield of the susceptibles was 286 bushels of No. 1's and 352 total and of the resistant varieties the yields were 269 bushels of No. 1's and 365 bushels total yield, an insignificant difference. Whereas, in the 12 locations where blight was serious the yield of the susceptibles was only 87 bushels of No. 1's and 187 bushels total and of the resistant varieties 222 bushels of No. 1's and 343 bushels total or a difference of 135 bushels No. 1's and 156 total, an extremely important difference.

Blight rot was counted only on tubers over 2 inches in diameter. This proved to be a poor measure of blight resistance for where blight was serious early in the season, very few tubers on the susceptible varieties ever reached the 2-inch size. In 6 locations blight killed both Rurals and Green Mountains so early that the yield of No. 1 potatoes did not exceed 50 bushels per acre.

No blight resistance has been claimed for the tubers of these resistant varieties. However, the tops of the resistant varieties remained alive from 4 to 6 weeks after Katahdins, whereas the Rurals and Green Mountains had been killed by late blight.

The potential yielding power of any variety, when grown under

TABLE 3.—*Yield by locations.*

Location	Weighted Yield per Acre						Potatoes per Hill				
	Over 2"				Under 2"	Total	Over 2"			Under 2"	Total
	US No. 1's	Scabby	Sunburn	Other Defects			US No. 1's	Scabby	Blight Rot		
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	No.	No.	No.	No.	No.
1 Aqueboque	414	0	5	9	68	496	5.18	.00	0	2.71	8.06
2 Laurel	388	2	13	8	101	512	5.20	.02	.004	4.44	9.97
3 Maples	290	10	31	20	61	412	3.68	.22	.024	2.60	7.08
4 Ithaca	120	7	33	24	51	235	1.78	.20	.172	2.54	5.22
5 Cincinnatus	171	1	1	18	53	244	2.50	.02	.426	2.31	5.28
6 Heuvelton	62	258	7	22	52	381	0.94	3.53	.016	2.12	6.68
7 Candor	209	2	1	1	51	264	2.89	.02	.326	2.56	5.50
8 Bath	330	3	17	41	56	447	4.12	.03	0	2.11	7.03
9 Clinton	191	3	5	6	47	252	2.96	.04	0	1.89	5.03
10 Argyle	215	3	4	1	54	277	3.42	.06	0	2.77	6.36
11 Mt. Vision	256	1	18	8	55	338	3.49	.12	0	2.31	6.24
12 Broadalbin	149	4	0	0	86	240	2.74	.08	0	4.14	6.98
13 Lounsbury	190	6	10	4	68	278	2.97	.10	0	3.66	6.90
14 Little Valley	213	28	7	57	62	367	2.78	.39	.798	2.64	6.74
15 Middletown	148	20	12	18	83	281	2.22	.30	.050	4.02	6.98
16 Marathon	189	28	4	4	71	296	2.76	.33	0	3.65	6.90
17 Richford	219	1	5	5	60	290	3.04	.01	.100	2.64	5.86
18 Williamson	303	4	1	0	47	355	4.67	.06	0	1.94	6.70
19 Ashland	231	4	24	7	105	371	3.34	.05	.070	5.39	9.24
20 Whitesville	301	5	40	13	47	406	3.66	.07	.026	2.04	6.51
Average	229	19.6	11.8	13	03.7	337	3.21	.271	.1006	2.92	6.76
LSD 1 per cent	62	29	17	—	27	85	1.16	.40	.16	1.18	1.52
LSD 5 per cent	47	22	13	—	20	65	0.88	.30	.12	.89	1.16

ideal conditions might be expected to be somewhat in proportion to the total number of tubers per plant. The named varieties excelling in this feature in the order of the total number of tubers per plant were Essex, Chenango, Virgil, Snowdrift and Placid. These were all significantly higher at (1 per cent level) than were Katahdins.

When appearance of the tubers was considered, 3 varieties, Chenango, Empire and Snowdrift, were as good if not better than Katahdin at all locations. All 3 of them yielded better than Katahdin as shown in table 4. Those that were rated as rough and unattractive in 20 per

TABLE 4.—*Number of locations where the general appearance of the tubers was rated as too rough to satisfy the general market demand.*

Variety	No. Locations	Variety	No. Locations
Ashworth	2	EVI—2	6
Chenango	0	FBY—1	2
CRF—3	3	FIG—3	1
DUA—2	3	Fillmore	5
DUA—11	5	Green Mountain	2
DVA—10	3	Katahdin	0
DXM—3	1	Placid	6
DZE—10	4	Rural	1
Empire	0	Snowdrift	0
Essex	4	Virgil	8

cent or more of the locations were Virgil, Placid, EVI-2, Fillmore, DUA-11, Essex and DZE-10. The best yielding variety was Essex, but besides being the most susceptible to scab, its appearance was rated rough and unattractive at 4 of the 20 locations.

This test covered only 1 planting date (late) in one year, 1947, but since it covered 20 locations the results justify consideration. It may be concluded that under conditions where blight control is not likely to be good, it would be safer to plant almost any of the blight-resistant varieties rather than the standard blight-susceptible varieties.

A PRELIMINARY STUDY ON THE USE OF RAPID CHEMICAL TESTS AS AIDS IN DIAGNOSING NUTRIENT DEFICIENCIES IN THE IRISH POTATO[1]

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The problem of determining the fertilizer requirements of a growing crop is one which has long concerned workers in plant nutrition. Use has been made of soil and plant analysis, pot tests, and field tests. The advantages and disadvantages of each of these methods have been discussed elsewhere (19) and need not be repeated here. It is apparent, however, that the concentration of a nutrient element extracted from actively growing tissues of plants should be an accurate indication of the effective concentration of that element in the soil. A number of investigators have devised rapid chemical tests for determining the concentrations of nutrients in plant tissues. Emmert (4, 5, 6, 7) has developed such tests which he has used (8) to determine the fertilizer requirements of tomatoes grown in Kentucky. Carolus (2, 3) has used Emmert's tests for nitrogen and phosphorus and an adaptation of Morgan's (15) soil testing methods for Mg O (magnesium oxide), K_2O (potash), and CaO (caldium oxide), on vegetable crops in Virginia. Thornton (20) and Thornton, *et al* (21) have developed similar tests which have been shown by Scarseth (18) to be valuable in diagnosing fertilizer needs. Hester (9) and Wolf (22) have used tissue tests as aids in recommending fertilizer applications.

Whether or not such tissue tests would be of diagnostic value for crops grown under Minnesota conditions has not been determined. The preliminary study reported here was made to determine the association between nutrient content of leaf petioles at various stages of growth as obtained by rapid chemical tests and yields of potatoes grown under various levels of soil fertility.

MATERIALS AND METHODS

All potatoes were grown at Brooklyn Center on a soil which has been classified as a Hubbard loamy sand (14). Previous fertilizer trials had shown this soil to be deficient in nitrogen, and soil analyses using methods devised by Purvis and Blume (17) indicated that the soil was

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[3]The author acknowledges his indebtedness to Mr. Dean Emrick, laboratory technical assistant in the Division of Horticulture for aid in the chemical analyses.

"low" in Ca, Mg, NH_4-N, and NO_3-N, "medium" in P and "medium" to "high" in K. The pH of the soil was 5.76. The tests for Al were negative.

The fertilizer treatments applied were as follows:

Treatment	Lbs. per Acre N	Lbs. per Acre P_2O_5	Lbs. per Acre K_2O
1	0	160	160
2	80	160	160
3	160	160	160
4	160	0	160
5	160	80	160
6	160	160	0
7	160	160	80
8	0	0	0

Nitrogen was supplied in the form of 20 per cent ammonium sulphate, potash in the form of 60 per cent muriate of potash, and the phosphate in the form of 43 per cent superphosphate.

On the 15th of April, deep furrows were opened, the fertilizers were scattered in the bottom of the furrow by hand, two inches of soil were raked over the fertilizer, and potato seed pieces of the Cobbler variety were planted on top of this soil and covered. Each of the fertilizer treatments was applied to four randomized plots, each plot being a single, two-rod row containing 20 seed pieces spaced 18" apart in the row. To avoid possible fertilizer effects from adjacent plots, single, unfertilized rows of potatoes were planted between treatment plots.

Leaf petiole samples for chemical analysis were taken on the 5th, 17th, and 24th of June, and on the 1st, 8th and 15th of July. On the 5th of June plants had 6-10 leaves; on the 17th flower buds were apparent in all plots; and on the 24th plots were in full bloom except those in minus N plots which were about one week late in blooming. All samples were taken between 8:30 and 9:30 a. m. The plant sample taken for chemical analysis consisted of the sixth leaf from the growing tip of the primary stems of 5 to 10 plants. All samples were immediately brought to the laboratory where the leaflets were stripped off, the remaining 10-15 grams of petioles were then cut into pieces 2 to 3 mm. in length, and the plant sap extracted from a 5-gram sample by the method outlined by Carolus (3). All extracts were stored in a refrigerator at 1-2°C. until analyses were made.

The procedures for determining the soluble N and soluble P content were those used by Carolus (3) with the exception that only 0.5 ml. of extract was used for each determination and the readings made by the

use of a Klett-Summerson photo-electric colorimeter equipped with a No. 42 blue filter. The procedure outlined by Carolus (3) for the determination of the potash (K_2O) content was used in modified form. To 2 ml. of the diluted extract were added 2 ml. of cold 0.5 N sodium acetate followed by the addition of 0.5 ml. of cold 0.1 N sodium hydroxide. After thorough shaking, 0.25 ml. of a 0.25 per cent solution of gum arabic, 0.5 ml. of cold 10 per cent sodium cobaltinitrite, and 5 ml. of cold 95 per cent ethyl alcohol were added in that order. After thorough shaking for 30 seconds the solution was allowed to stand for 4 minutes after which the sample was read in the photoelectric colorimeter using the No. 42 blue filter. The standards used (3) were run through the same procedure as the unknown samples. It was found that in order to obtain reproducible readings it was necessary to keep all reagents at approximately 7°C. The sodium acetate buffered the solution between pH 5.7 and 6.0 and the gum arabic prevented too rapid settling of the precipitate and thus allowed the use of the colorimeter.

Results

The soluble N contents of leaf petioles, and yields of potatoes grown under the eight fertilizer treatments are given in table 1. Nitrogen ap-

Table 1.—*Soluble nitrogen content of potato leaf petioles at successive stages of growth, and yields of potatoes, following application of eight fertilizer mixtures.*

Nutrients Applied per Acre			Soluble N in Leaf Petiole Tissue on Indicated Dates:						Yields of Tubers per Acre
N	P_2O_5	K_2O	6/5	6/17	6/24	7/1	7/8	7/15	
Lbs.	Lbs.	Lbs.	P.p.m.	P.p.m.	P.p.m.	P.p.m.	P.p.m.	P.p.m.	Bushels
0	0	0	413	300	274	263	216	218	81
0	160	160	352	282	230	241	228	234	88
160	160	160	850	725	520	432	426	441	169
160	0	160	822	652	460	405	409	528	171
160	160	0	797	624	532	456	455	484	172
80	160	160	769	546	505	384	346	388	173
160	80	160	766	616	466	433	397	469	173
160	160	80	691	664	496	442	382	429	189
Diff. necessary for odds of 19:1			141	136	107	93	71	60	32

plications to the soil used in this experiment approximately doubled the yields of potatoes obtained. However, increasing the nitrogen application from 80 pounds to 160 pounds per acre did not result in further

increase in yield. The soluble nitrogen content of leaf petioles from plants in nitrogen-fertilized plots was approximately double that in plants from unfertilized plots. Increasing the soil application of nitrogen from 80 pounds to 160 pounds per acre did not significantly increase the nitrogen content in the plants.

The effects of phosphate and potash fertilization on the nitrogen content of potato leaf petioles are best shown in the three sets of graphs across the top of figure 1. Omitting nitrogen from the fertilizer applied resulted in greatly reduced nitrogen content in the plants. Omitting either phosphate or potash from the fertilizer, however, had no effect on the nitrogen content of the plant.

Variations in the soluble phosphorus content of plants grown under the eight fertilizer treatments are given in table 2. The more important

TABLE 2.—*Soluble phosphorus content of potato leaf petioles at successive stages of growth and yields of potatoes following application of eight fertilizer mixtures.*

Nutrients Applied per Acre			Soluble P in Leaf Petiole Tissue on Indicated Dates:						Yields of Tubers per Acre
N	P_2O_5	K_2O	6/5	6/17	6/24	7/1	7/8	7/15	
Lbs.	Lbs.	Lbs.	P.p.m.	P.p.m.	P.p.m.	P.p.m.	P.p.m.	P.p.m.	Bushels
0	0	0	490	575	638	510	517	371	81
0	160	160	564	614	653	506	588	494	88
160	160	160	327	388	376	324	278	184	169
160	0	160	259	313	245	122	123	99	171
160	160	0	285	332	345	236	243	171	172
80	160	160	324	380	357	331	248	172	173
160	80	160	287	343	340	232	168	133	173
160	160	80	269	312	345	269	250	236	189
Diff. necessary for odds of 19:1			84	67	107	103	127	111	32

effects of variations in nutrient supply on phosphorus content are shown in figure 1 in the center row of graphs. Plants which had received no nitrogen fertilizer contained the greatest quantities of soluble phosphorus. These results are in agreement with those found by Carolus (3) and others (1, p. 43) for potatoes and Emmert (8) for tomatoes. In the absence of adequate nitrogen supply, the application of phosphate and potash had no significant effect on soluble phosphorus content. However, in the presence of adequate nitrogen supply, the application of phosphate significantly increased the phosphorus content of plants,

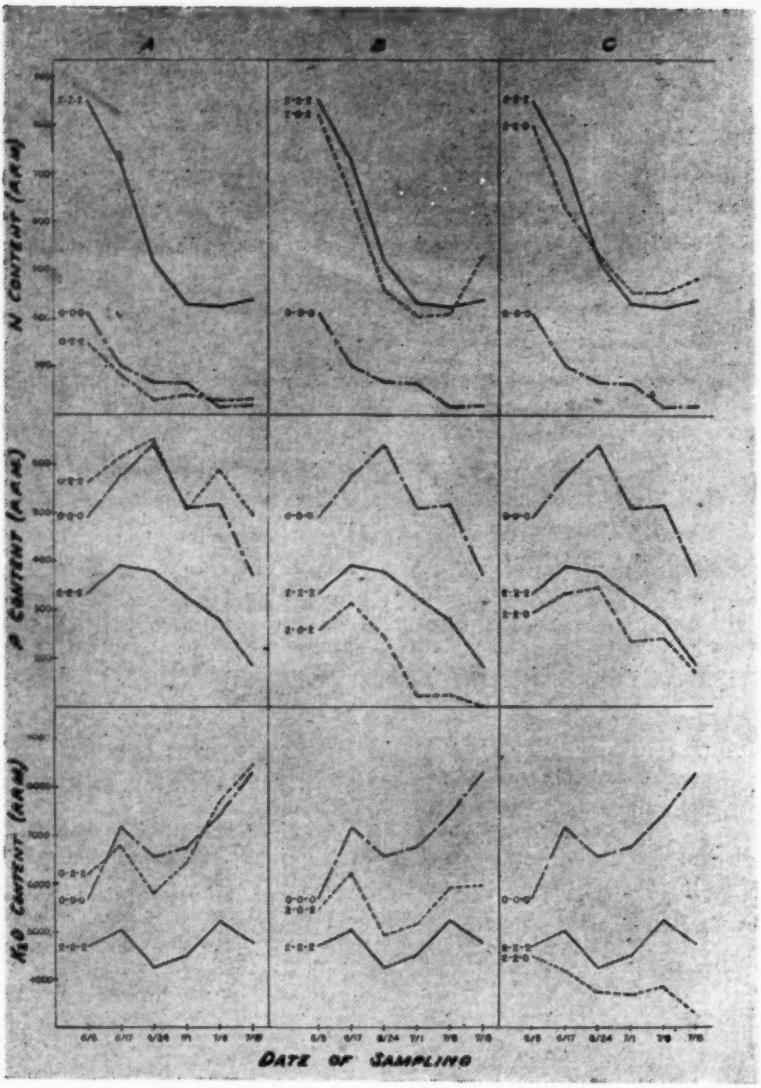

FIGURE I—N, P, and K2O content of potato leaf petioles at successive dates under different levels of N P, K supply. (The fertilizer ratio applied is indicated at the left of each curve; 2-2-2 indicating 160 lbs. N, 160 lbs. P_2O_5, and 160 lbs. K_2O respectively.

whereas potash fertilization had no significant effect on phosphorus content. MacGregor and Rost (13) and Lucas, *et al* (12) found that phosphate fertilization had little effect on phosphorus content of pota-

toes, whereas Lorenz (11) and Carolus (3) found that phosphate fertilization markedly increased the phosphorus content of young plants.

Table 3 shows the soluble potash content of potato leaf petioles at successive stages of growth following the application of the eight fertilizer mixtures. In figure 1, bottom row of graphs, are shown the more important effects of variations in nutrient supply on potash content. Plants which had received no nitrogen contained the greatest quantities of soluble potash. These results agree with those obtained by Knowles and Watkins (10) and Carolus (3) with potatoes and Phillips, *et al* (16) with tomatoes. Under conditions of low nitrogen supply, the application of phosphorus and potash fertilizer had no significant effect on potash content. However, under conditions of high nitrogen supply, withholding phosphate fertilizer significantly raised the level of potash in the plant, whereas withholding potash fertilizer significantly reduced the potash content of plants.

Examination of the graphs in figure 1, indicates inverse relationships between the nitrogen content and the phosphorus and potash content of potato leaf petioles. Correlation coefficients calculated for the data obtained on the sampling dates 6/5 and 7/15 confirm this:

Correlation between	"r" for 6/5 Data	"r" for 7/15 Data
N and P	—.926**	—.964**
N and K_2O	—.633	—.819*
P and K_2O	+.735*	+.703

The negative correlations obtained between N content and P content were highly significant for both dates. The negative correlation between N and K_2O contents approached significance for the data obtained on 6/5 and was significant at the 5 per cent level for the data obtained on 7/15. The positive correlation coefficient between P and K_2O content was statistically significant for the 6/5 data and approached significance for the 7/15 data.

Discussion

In the study here reported, the yield data indicate that the soil in which the potatoes were grown was deficient in nitrogen. An application of 80 pounds of nitrogen per acre approximately doubled the yield of tubers. This application of nitrogen also approximately doubled the nitrogen content of the plants. The differences in nitrogen content of N-fertilized and unfertilized plants were present at least as early as the 5th of June, eight weeks after planting or about four weeks after

emergence of the plants. The plants at this time had 6-10 leaves. At this stage of growth, the leaf petioles of N-fertilized plants contained 850 p.p.m. of soluble N, whereas plants not receiving nitrogen contained 350 p.p.m. Two weeks later, when plants had visible flower buds, N-fertilized plants contained 725 p.p.m. of N as compared to 280 p.p.m. in minus N-fertilized plants. For the period during which leaf samples were analyzed (6/5 to 7/15) the N-fertilized plants ranged in N content from 850 to 441 p.p.m. whereas the N content of plants not receiving N fertilizer ranged from 352-234 p.p.m The fact that increasing the quantity of nitrogen fertilizer applied from 80 pounds to 160 pounds per acre raised the range in nitrogen content from 769-388 p.p.m. to only 850-441 p.p.m. without resulting in further increases in yield indicates that the 80-pound application was adequate under the conditions of this experiment and that a nitrogen content of 600 to 700 p.p.m. at the time of first visible flower buds was an adequate level of N in the plant for maximum yields.

That the phosphorus content of the soil used in this study was adequate for good yields of potatoes is indicated by the fact that applications of phosphate had no beneficial effects on yields. The inverse relationships found between phosphorus content and the nitrogen content of plants were also obtained by Emmert (8) and Carolus (3). Emmert (8) states that the negative correlations in his tests between yields and the phosphorus content of tomato plants were "undoubtedly due to accumulations of phosphorus not used by the plants because some other factor has stopped or retarded growth." It can be safely assumed that, in this experiment the accumulation of phosphorus in leaf petioles was associated with the retardation of growth due to nitrogen deficiency. Carolus (3) indicates that the "phenomenon of soluble phosphorus accumulation in nitrogen deficient plants may usually be used as a check on a nitrogen deficiency." From the data in table 2 it appears that a soluble phosphorus content of 300-400 p.p.m. at the time of first visible flower buds was adequate for the production of maximum yields under the conditions of the experiment reported here.

As in the case of phosphorus, an inverse relationship between potash content and nitrogen content was found in this study. Apparently, potash also accumulates in plants whose growth has been retarded due to some other limiting factor. That the potash supply in the soil used in this study was sufficient to produce a maximum crop is indicated by the fact that an application of potash fertilizer did not result in increased yields when other growth factors were not limiting. Under the conditions of this experiment a potash content, in the leaf petioles, of

TABLE 3.—*Soluble potash content of potato leaf petioles at successive stages of growth and yields of potatoes following application of eight fertilizer mixtures.*

Nutrients Applied per Acre			Soluble K_2O in Leaf Petiole Tissue on Indicated Dates:						Yields of Tubers per Acre
N	P_2O_5	K_2O	6/5	6/17	6/24	7/1	7/8	7/15	
Lbs.	Lbs.	Lbs.	P.p.m.	P.p.m.	P.p.m.	P.p.m.	P.p.m.	P.p.m.	Bushels
0	0	0	5680	7180	6560	6750	7420	8290	81
0	160	160	6180	6780	5800	6430	7710	8470	88
160	160	160	4710	5030	4260	4510	5230	4780	169
160	0	160	5450	6210	4930	5160	5910	5970	171
160	160	0	4490	4210	3760	3690	3860	3300	171
80	160	160	5750	6160	5630	5540	6040	6530	173
160	80	160	4750	5420	4010	4710	5420	5580	173
160	160	80	4310	4610	4000	3720	4870	4390	189
Diff. necessary for odds of 19.1			780	920	1050	560	1340	1190	32

4200 to 6200 p.p.m. at the time of first visible flower buds was adequate for the production of gold yields of tubers.

SUMMARY

1. The effects of soil applications of nitrogen, phosphorus, and potash fertilizers on the soluble nutrient content of potato leaf petioles and on yields of tubers were studied. Rapid tissue tests were used to determine the nutrient content of leaf petioles at successive intervals during the growing season.

2. Soil applications of nitrogen fertilizer at the rate of 80 pounds or 160 pounds per acre approximately doubled the N content of potato leaf petioles and doubled the yields of tubers. The concentrations of soluble P and K_2O were found to be inversely correlated with the soluble N content of potato leaf petioles.

3. Soil applications of phosphate fertilizer had no effect on yields of tubers, nor on soluble N content of potato leaf petioles. Under conditions of high N supply, application of phosphate fertilier resulted in significantly higher P content and in slightly lower soluble K_2O content of leaf petiole tissues.

4. Soil applications of potash fertilizer had no effect on yields of tubers nor on the soluble N content of potato leaf petioles. Under conditions of high N supply, application of potash fertilizer resulted in significantly higher soluble K_2O content but had no effect on soluble P content of leaf petiole tissues.

5. Under the conditions of this experiment, the maximum yields

were obtained when the soluble N content of the leaf petioles at the time of first visible flower buds were 600-700 p.p.m.; the soluble P content was 300-400 p.p.m.; and the soluble K_2O was 4200-6200 p.p.m.

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CURRENT RESULTS WITH POTATO VINE[1] KILLERS IN PRINCE EDWARD ISLAND[2]

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Killing the potato vines prior to harvesting the crop is a practice in modern potato culture that is annually being adopted by increasing numbers of Prince Edward Island growers. This practice has become so firmly established in this province that the majority of growers are now using vine-killing chemicals for one or more of the several purposes (1, 3, 5) for which they have been developed. The growers have readily accepted the local recommendation to treat all fields in which the vines are green not later than the 1st of October. This recommendation was designed to advance the date of digging and thereby reduce the number of oversized tubers in a year with an extended growing season, to permit harvesting of the crop before the advent of inclement weather or freezing temperatures, and to reduce the incidence of late blight tuber rot. In connection with it, growers are advised to delay harvesting until at least ten days after the death of the vines. During this period the tubers loosen from the stolons and the skin matures or toughens, rendering the potatoes less susceptible to mechanical injury during digging and subsequent handling. The Sebago, in particular, is easily bruised. It is recommended that this variety be left in the ground three or four days longer than the other varieties grown in the province.

A great deal of rot, especially in Sebagos, developed in the 1946 crop while in storage and in transit. An extensive survey revealed that the heavy losses were caused by *Fusarium sambucinum* f.6, which gained entrance into the tubers through cuts, wounds, and abrasions inflicted during harvesting operations. The autumn of 1946 was unusually mild and open, and chemicals for destroying the vines were in short supply. Consequently, many fields were dug while the plants were still green. The tubers harvested under these conditions were very easily bruised, even by light blows, as the skin was still immature.

Experiments with a number of chemicals and commercial herbicides (1) have been conducted at the Dominion Laboratory of Plant Pathology at Charlottetown and in growers' fields since 1941. The laboratory plots

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for the 1947 tests were planted on the 11th of June and treated on the 8th of September—the variety used being Green Mountain. The plants, at time of treatment, were disease-free and exceptionally luxuriant and vigorous. Although the sprays were applied at a pressure of 300 pounds, and the machine was equipped with four nozzles per row and driven both ways of the rows, it was difficult to cover the heavy mass of growth completely. The weather on the 8th of September and for the ensuing week was probably ideal for the killing tests. Weather data are presented in table 1.

A summary of the effectiveness of the materials tested is given in table 2. The very marked increase in the toxicity of sodium arsenite sprays, represented in table 2 by Handy Killer, that the addition of an oil made, was the most outstanding feature of the experiment. Preliminary tests, conducted in the greenhouse during the winter, clearly indicated that potato vines were more readily destroyed by a solution of sodium arsenite when an oil was included in the spray. Tests conducted in field plots early in August substantiated the results obtained in the greenhouse, and waste crank case oil was found to be just as effective as miscible oil. Tests were made with three sodium arsenite vine killers—Handy Killer, Green Cross Top Killer, and Geigy's Potato Vine Killer—and it was noted that equal amounts of waste crank case oil increased the toxicity of each to the same extent. Various procedures for mixing the components were studied and it was found that the most effective spray was obtained by stirring the commercial concentrated solution of sodium arsenite and oil together, adding the resulting mixture to the sprayer tank, and finally adding the water while the agitators were turning. This method of preparation emulsified most of the oil. Excellent kill was obtained when the vines were sprayed with a mixture containing one quart of a sodium arsenite vine killer and two gallons of waste crank case oil in forty gallons of water. Several farmers were asked to compare a sodium arsenite solution with a sodium arsenite-oil mixture, and all reported better results with the latter preparation.

The plots were harvested on the 22nd of September, tubers were examined for discoloration at the stem-end and in the vascular ring, and a bushel sample from each plot was put in storage for later examination. No discoloration was found in the tubers of the check plots, but the samples from the treated plots showed varying degrees of browning as shown in table 3. The incidence of browning under the point of stolon attachment was apparently correlated with the rapidity of the kill: the chemicals that caused the most rapid kill in-

TABLE 1.—*Weather data for period of top killing, 1947.*

	Sept. 8	Sept. 9	Sept. 10	Sept. 11	Sept. 12	Sept. 13	Sept. 14	Mean
Min. Temp.	48	57	62	68	55	63	66	59.9
Max. Temp.	68	66	83	86	80	67	74	74.9
Hours Sun	10.4	8.3	8.7	9.6	9.6	10.3	5.5	9.0
Precipitation	0.03	—	—	—	—	0.14	—	—
Rel. Humidity	67	71	83	82	79	81	81	77.7

TABLE 2.—*Comparison of the effect of vine killers, 1947*

Treatment	Number of Days after Application			
	1	2	4	6
Handy Killer 2 qts — 80	Moderate leaf burn.	70 per cent leaves burned.	All leaves dead. Stems green.	Stems green.
Handy Killer + oil[1] 2 qts. + 4 gals. — 80	Pronounced leaf burn.	90 per cent leaves burned.	All leaves dead. Stems green.	Dead.
Green Cross Top Killer. 2 qts. — 80	Moderate leaf burn.	80 per cent leaves burned.	All leaves dead. Stems green.	Stems green.
Krenite 2 gals — 80	Moderate leaf burn.	Moderate leaf burn.	70 per cent leaves burned.	Not satisfactory.
Krenite + oil. 1 gal. + 4 gals. — 80	Slight leaf burn.	Moderate leaf burn.	65 per cent leaves burned.	Not satisfactory.
Dowspray 66 1 gal. — 80	Severe leaf burn.	All leaves dead. Stems green.	Stems green.	Some stems green.
Dowspray 66 2 gals — 80	Very severe. leaf burn.	All leaves dead. Stems green.	Most stems dead.	Dead.
Sinox W 1 gal. — 80	Severe leaf burn.	90 per cent leaves burned. Stems green.	All leaves dead. Stems green.	Some stems green
Sinox General + oil. 1 qt. + 3 gals. — 80	Severe leaf burn.	All leaves dead. Stems green.	Most stems green.	Dead.

[1]Waste crank case oil was used in all sprays in which oil is mentioned.

duced the most pronouncel effects. A similar tendency was reported by Hoyman (2) and Richardson (4), and was observed in experimental material at Charlottetown in 1946. (1). Discoloration of the vascular ring beyond the extreme stolon end occurred in tubers from plots treated with dinitro sprays, but was not found in tubers from other plots. A few tubers from plots sprayed with Krenite (sodium dinitro ortho cresylate) showed a faint browning of the vascular ring, but, as shown in table 2, the plants treated with this material were only partially killed. Browning of the vascular ring was somewhat more pronounced in tubers from plots treated with Sinox General (dinitro ortho secondary amyl phenol) and Sinox W (ammonium dinitro ortho secondary butyl phenol), but the tubers from plots treated with Dowspray 66 Improved (dinitro ortho secondary butyl phenol) were severely affected, in some tubers the vascular ring being discolored as far as midway to the eye end. In table 4 are presented the results of the examination made on the stored tubers during the last week of November. The differences among the samples had largely disappeared, except for the samples from plots treated with Dowspray 66 Improved. Discoloration, especially in the vascular ring, was very prominent in the stored tubers from the plots treated with this chemical. Cooking tests were conducted at this time, but no differences in flavor or texture of the flesh were discernible among the tubers from the several treatments.

Steinbauer (5) reported that slight discoloration of the vascular bundles sometimes occurs in Maine subsequent to the application of vine killers, especially dinitro compounds, and Hoyman (2) observed a brown discoloration of the vascular tissue two days after the application of Dowspray 66 Improved. Similar injury was observed in Ontario (1,4) in 1946, but not in Prince Edward Island (1). The very considerable difference in the amount and intensity of the discoloration induced by Dowspray 66 Improved in the Charlottetown tests of 1946 and 1947, suggests the possibility that some presently unknown factor, perhaps seasonal, may have an influence on the results. It should also be noted that, although several workers on this continent have reported a discoloration of the vascular tissue of tubers following the destruction of the plants by chemical vine killers, no such phenomenon has been observed in Britain (6). The summer season—July, August, and September of 1947 was characterized by a higher mean temperature, more sunshine, and less rain than the corresponding period of 1946. July and August were unusually dry months, rainfall being below the average for these periods, and the mean temperature for

TABLE 3.—*Amount of intensity of discoloration in tubers in fourteen days after application of vine killers, 1947.*

Treatment	Concentration per 80 Gals.	Per cent Free	Per cent Incipient	Per cent Moderate	Per cent Severe	Rating
Check (tops green)	——	50	50	0	0	5.0
Check (tops dead)	——	—	—	—	—	—
Tops cut off	——	8	36	48	8	12.4
Handy Killer	2 qts.	28	48	24	0	8.4
Handy Killer + oil[1]	2 qts. + 4 gals.	2	46	46	6	12.7
Green Cross Top Killer	2 qts.	6	54	38	2	11.5
Krenite	2 gals.	18	40	38	4	10.5
Krenite + oil	1 gal. + 4 gals.	22	64	14	0	8.5
Dowspray 66	1 gal.	0	12	48	40	16.4
Dowspray 66	2 gals.	0	2	46	52	17.5
Sinox W	1 gal.	2	32	56	10	13.6
Sinox General + oil	1 qt. + 3 gals.	2	42	48	8	13.0

[1]Waste crank case oil was used in all sprays in which oil is mentioned.

TABLE 4.—*Amount and intensity of discoloration in tubers after two months in storage, 1947.*

Treatment	Concentration per 80 Gals.	Per cent Free	Per cent Incipient	Per cent Moderate	Per cent Severe	Rating
Check (tops green)	——	2	69	27	2	11.3
Check (tops dead)[1]		7	77	14	2	10.2
Tops cut off	——	1	38	53	8	13.3
Handy Killer	2 qts.	0	78	19	3	11.2
Handy Killer + oil[2]	2 qts. + 4 gals.	1	68	27	4	11.6
Green Cross Top Killer	2 qts.	0	70	24	6	11.8
Krenite	2 gals.	0	47	45	8	13.0
Krenite + oil	1 gal. + 4 gals.	0	58	37	5	12.3
Dowspray 66	1 gal.	0	21	39	40	15.9
Dowspray 66	2 gals.	0	19	37	44	16.2
Sinox W	1 gal.	2	58	23	17	12.6
Sinox General + oil	1 qt. + 3 gals.	0	43	41	16	13.6

[1]Dug later, after plants had been killed by frosts.
[2]Waste crank case oil was used in all sprays in which oil is mentioned.

July was the highest ever recorded for this month. Weather data for the summer months of 1946 and 1947 are presented in table 5.

It has been suggested that among other factors (1), the stage of development of the plant at the time of killing might have a bearing on the incidence of vascular discoloration in the tubers. In 1947 randomized and replicated plots of Green Mountains were treated with Dowspray 66 Improved on the 11th and 27th of August and on the 8th and 22nd of September which is 61, 77, 89, and 103 days, respectively, after planting. The chemical was used at a concentration of two gallons in eighty gallons of water and applied in the same way as that described above. Fourteen days after each application, the tubers were lifted and examined by removing one or more slices from the stolon end.

The results of these examinations are shown in table 6, in which it is indicated that the severity of the discoloration increased quite regularly from the first to the last killing of vines. It was also observed that the plants were killed more quickly as the season advanced, an observation that again suggests the possibility that the phenomenon is correlated with the rapidity of the kill.

Summary

1. Dowspray 66 Improved and Sinox General were the most effective potato vine killers tested at Charlottetown in 1947.

2. Sodium arsenite herbicides killed the vines slowly, several days being required to accomplish the death of the plants, but the addition of oil, such as fuel oil, a miscible oil, or waste crank case oil, resulted in mixtures that destroyed the vines as quickly and completely as Dowspray 66 Improved or Sinox General.

3. The premature killing of vines may induce a discoloration in the vascular tisues of the tubers. Dinitro compounds, especially dinitro ortho secondary butyl phenol, induced the most pronounced discoloration.

4. Tubers harvested from untreated cut vines showed a greater incidence of stem-end discoloration than tubers from untreated check plants, or from plants destroyed by slow acting herbicides.

5. Further data were obtained in support of the theory that tuber vascular discoloration is correlated with the rapidity of the kill.

6. The amount and intensity of discoloration in tubers from plants killed at different stages of development with dinitro ortho secondary butyl phenol increased quite regularly with the age of the plants. Those killed late in the season exhibited the greatest injury.

7. The culinary quality of potatoes was not impaired when the plants were destroyed by vine killers.

TABLE 5.—*Weather data for summer months of* 1946 *and* 1947.

	July		August		September		Mean	
	1946	1947	1946	1947	1946	1947	1946	1947
Mean temp.	65.0	71.8	65.5	66.3	61.4	59.2	64.0	65.8
Hours—sun	264.1	232.1	189.1	278.6	184.8	212.6	212.7	241.1
Inches—rain	2.63	2.57	4.05	1.34	2.63	4.72	3.10	2.88

TABLE 6.—*Amount and intensity of discoloration in tubers from plants killed at intervals with Dinitro ortho secondary butyl phenol,* 1947.

Date Killed	Per cent Free	Per cent Incipient	Per cent Moderate	Per cent Severe	Rating
August 11	7.3	52.7	30.7	9.3	11.7
August 27	0.0	26.0	52.7	21.3	14.8
September 8	0.0	17.3	46.7	36.0	15.9
September 22	0.0	5.3	51.7	43.0	16.9

Legend of Figures

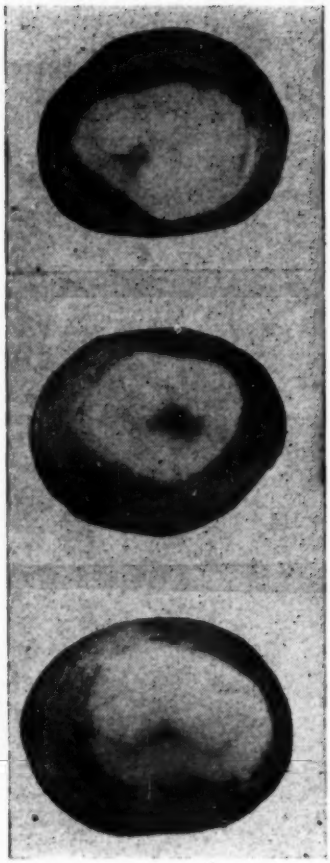

FIGURE 1—Vascular ring discoloration in Green Mountains from vines sprayed with dinitro ortho secondary butyl phenol.

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FIRMNESS OF POTATO VARIETIES AS MEASURED BY A PRESSURE TESTER[1]

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The firmness of flesh of potato tubers as measured by a pressure tester was determined for nine varieties grown at thirteen locations in Minnesota. The results obtained were compared with the dry matter of the samples as measured by specific gravity.

The instrument used for measuring firmness was similar to that described by Magness and Taylor (*1*) for determining fruit maturity. The pounds of pressure required to force a plunger 5/16 of an inch in diameter into a potato tuber to a depth of 5/16 inches was determined. Tests were made at approximately the same position on each tuber. No tests were made in close proximity to the eyes. Prior to testing, a portion of the skin was removed at the point of testing on each tuber. One reading per tuber was taken. Each sample consisted of ten tubers chosen for uniform size and taken from each of two replications of nine varieties grown at thirteen locations. The specific gravity of these samples was determined by means of a wet and dry weight method whereby the specific gravity was calculated by dividing the dry weight of the sample by the loss of weight in water. The dry matter was then determined from tables prepared by Von Scheele *et al* (*2*).

The variances due to variety, location, and the interaction of variety and location for pressure test and for specific gravity and the correlation coefficients as determined by the analysis of covariance are

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TABLE 1.—*Variances and correlation of pressure test and specific gravity of potatoes.*

Variation Due to	Degrees of Freedom	Variances		Correlation Coefficient (1)
		Pressure Test	Specific Gravity	
Variety	8	82.37**	1079.07**	.4824
Location	12	22.91**	584.43**	.3502
Block	1	.86	.04	—.002
Variety x Location	96	5.25**	16.84**	
Error	103	1.18	7.08	

**Significant at the one per cent point.
(1) Total correlation coefficient 0.316**

given in table 1. The variances due to variety, location, and the interaction of variety and location were highly significant for both pressure test and specific gravity. The association between pressure test readings and specific gravity was significant only in the case of the total correlation. The correlation coefficients for variety and location were of the same order of magnitude as the total correlation. The relatively low total correlation coefficient 0.316 suggests that in addition to dry matter other internal factors influence the firmness of flesh as measured by the pressure tester.

The mean pressure test readings for nine varieties of potatoes tested at thirteen locations are given in table 2. The highest readings obtained were for the varieties Red Warba (21.88), Minn. 6 (21.66) and Minn. 42 (21.37); the lowest readings obtained were for Chippewa (17.24), Chicago (17.82) and Pontiac (17.92); whereas the readings for Minn. 43 (20.73), Waseca (20.22) and Minn. 126 (20.02) were intermediate.

Significant differences between the mean pressure test readings for the thirteen locations are indicated in table 3. The mean for Glyndon (21.87) was significantly higher than the mean for the other locations with the exception of East Grand Forks (21.43).

Significant variances were obtained for the interaction of variety with location. A small part of the data showing some of the interactions

TABLE 2.—*Pressure test readings of nine varieties of potatoes.*

Variety	Mean of Thirteen Locations	Variety	Mean of Thirteen Locations
Red Warba	21.88	Minn. 126	20.02
Minn. 6	21.66	Pontiac	17.92
Minn. 42	21.37	Chicago	17.82
Waseca	20.22	Chippewa	17.24
Minn. 43	20.73		

Difference necessary for odds of 19.1=0.60

TABLE 3.—*Pressure test readings for potatoes at thirteen locations.*

Locations	Mean of Nine Varieties	Locations	Mean of Nine Varieties
Glyndon	21.87	Fertile	19.47
E. Grand Forks	21.43	Fisher	19.22
McIntosh	20.93	Brooklyn Center	19.16
Crookston	20.60	Chicago City	19.00
Halstad	20.39	Carlton	18.46
Kennedy	20.00	Cambridge	18.13
Richfield	19.70		

Difference necessary for odds of 19:1=0.72

of variety with location for pressure test readings is given in table 4. Red Warba was significantly higher than Minn. 6 at McIntosh but lower at Glyndon. Pontiac was significantly higher than Chippewa at Fisher but the reverse was true at Cambridge. The influence of variety and location tended to give wide differences in pressure test readings,

TABLE 4.—*Pressure test readings showing interactions of variety with location.*

Location	Variety			
	Red Warba	Minn. 6	Pontiac	Chippewa
Glyndon	21.95	25.70	20.10	17.35
McIntosh	24.30	22.05	16.65	21.10
Fisher	19.25	20.50	20.30	13.70
Cambridge	22.15	20.20	15.40	18.05

Least significant difference for the interaction of variety with location=3.04.

for example: Minn. 6 at Glyndon gave a reading of 25.70, whereas Chippewa at Fisher gave a reading of 13.70.

The differences obtained in firmness of flesh between variety, location and the interaction of variety by location warrants further study to determine its possible relation to market and culinary quality.

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PLANS FOR THE MAINTENANCE OF VALUABLE FOREIGN AND CERTAIN DOMESTIC POTATO BREEDING STOCKS[1]

G. H. RIEMAN

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Investigators throughout the country, interested in potato improvement, recognize the need for a better system in order to maintain potato stocks of foreign and domestic origin for breeding purposes. The practice now in operation at the various potato breeding stations involves a compromise between breeding activities for particular objectives and the maintenance of stocks of unknown value or stocks possessing particular attributes which will be needed as the breeding program progresses. Facilities and funds are usually not available to carry along both lines of work equally well. Whenever a choice becomes necessary the maintenance of inactive breeding cultures is relegated to a secondary position or eliminated entirely. The need for a better program to maintain valuable potato germ plasm in this country is well summarized in the following statement made recently in a letter by Morrison, Principal Horticulturist in charge of the Division of Plant Exploration and Introduction, United States Department of Agriculture: "I am sorry, of course, that after all of the work which has been done in getting species of potatoes into this country for the various breeders, that no one has had either the facilities, or the time, or money to maintain the stocks."

It is fortunate that a more orderly program for plant introduction and maintenance has been made possible by the Research and Marketing Act of 1946. One activity suggested for support from this Act is the introduction, maintenance and testing of foreign plant materials. Committees at regional and national levels have been established during the past year to suggest plans and to propose an overall program to maintain desirable germ plasm.

It is now the responsibility of investigators interested in potato improvement to develop a suitable program for the introduction, maintenance, and testing of tuber-bearing species of *Solanum*. A national committee and four regional committees of potato workers including rep-

[1]Paper from the Department of Genetics, No. 378, Agricultural Experiment Station, University of Wisconsin. This paper was prepared for the Report of the Potato Breeding Committee for 1947, Potato Association of America.

resentatives of the Division of Plant Exploration and Introduction of the United States Department of Agriculture should be formed to develop a program for the introduction and maintenance of desirable potato stocks. These committees should determine (1) where heterogeneous collections of potato stocks can be maintained to the best advantage, (2) what facilities and personnel will be necessary, (3) what range and volume of material should be considered, (4) what material is on hand and what new material is desired and (5) the probable cost of an adequate program.

The introduction and maintenance station or stations should, if possible, be located independently of an associated breeding enterprise. This would safeguard the possibility of compromising the objectives to the detriment of the introduction and maintenance program. Furthermore, the introduction station should be located on an isolated farm in a favorable potato seed production area where the spread of diseases is naturally low. Adequate greenhouse, tuber and seed storage, laboratory and office facilities are essential. The plant scientist in charge should possess excellent integrating and coordinating ability and a willingness to cooperate with research workers at various experiment stations. Professional services and guidance in the fields of Plant Pathology, Entomology, Cytogenetics and Taxonomy should be available. Recognition of the susceptibility of the potato plant to numerous diseases suggests the wisdom of two widely separated introduction centers. It would also be highly desirable to establish the introduction stations as centrally as possible in relation to potato breeding projects.

The functional limits of the work to be carried on at the potato introduction stations should be clearly outlined. Stocks eligible for consideration should be indicated and the size of samples for distribution should be limited to very small quantities of tubers or seed. The following stocks might be placed on the eligible list: (1) foreign tuber-bearing species of Solanum; (2) foreign cultivated varieties: (3) minor American varieties not considered by certification agencies; and (4) seedlings possessing outstanding attributes which have been described in publications. A standing potato introduction committee could be exceedingly helpful in establishing an eligibility list of materials now available. Such a committee could also be helpful in arranging for the acquisition of new potato cultures and in discarding inactive stocks of questionable value. It is anticipated that virus infection alone may, under the best possible conditions, reduce many stocks to impotency. Experience with maintenance programs clearly indicates the need to provide for deletions as

well as additions. This will permit the program to continue to serve current requirements and to operate within established budgetary limits.

Recognition of the need for adequate testing of foreign introductions and of the need for a coordinated program among states was a part of the Andresen Bill whose provisions were considered when the Research and Marketing Act was written. The potato introduction committee should logically take an active part in planning a testing program outlined under this project. The various research laboratories might offer to serve as testing stations for certain characters such as blight immunity or early maturity in which they are interested, and with which they are well qualified to deal. The potato introduction and maintenance stations might undertake some testing responsibility, but this feature would readily increase costs and divert attention from their main objective. The stocks maintained at the introduction centers might be catalogued once each year with regard to both favorable and unfavorable characters observed by state and federal research workers.

The potato introduction committee or committees might also serve in a coordinating capacity in regard to the introduction of new foreign material. In the past there has not always been a close contact between the various research laboratories and the Division of Plant Exploration and Introduction. This is exemplified by the news of an expedition being planned at the present time to send Correll to Mexico to collect wild species of potatoes. Information of this type should be made available to every potato research laboratory in the country. Better yet, the research workers who are to use this material should be given an opportunity to make their needs known before a potato collecting expedition is planned.

The potato introduction committee might contact research workers regarding the need for new materials at definite intervals and might transmit these requests to the Division of Plant Exploration and Introduction. Plant explorers may, from time to time, learn about foreign potatoes which should be brought to the attention of American workers. Such information, too, could readily be made available through the potato introduction committee.

SECTIONAL NOTES

Maine

Our planting season is about one week ahead of last year. About the 10th of May we experienced fine weather when about 50 per cent of the potatoes were planted. The next nine days we experienced rain which has been followed by very good weather. Many farmers, however, are reporting some loss of seed in low spots. These spots vary from 2 rods to 20 acres in size. In the aggregate, the loss will not be large but it is serious for those unfortunate farmers.

Practically every farmer is staying within his potato allotment, even though to date the method of supporting prices after January has not been officially declared. Maine's allotment is approximately 185,000 of which Aroostook County alone has 168,995 acres.

A committee has already been appointed to make plans for the field meeting of the Potato Association of America which will be held in August. A big crowd is expected, and those attending may be assured of a typical Aroostook welcome. Maine potatoes are worth seeing in August.

The Farm Bureau Day is planned for Experimental Farm at Presque Isle on the 12th of August. Machinery exhibits will feature this Field Day.

Japanese millet is being grown by a great many farmers this year as a green manure crop. Because of its weed-controlling properties, it has made rapid strides in acreage during the past two years.

Some experimental work this spring, with pre-emergence sprays in potatoes for weed control, looks promising. Those who are interested might have a chance to see these if they attend the field meeting of the Potato Association of America.—Verne C. Beverly.

Nebraska

We will see a few potatoes planted this week, with the bulk of the late planted crop going into the ground between the 10th and 20th of June. Moisture conditions throughout the High Plains area of western Nebraska are excellent at this writing. A few growers are complaining that they are being held up with their plowing because of excessive moisture. However, this is an uncommon complaint.

The acreage of certified potatoes is expected to drop to a certain extent, possibly 9,000 acres for 1948. This is the second year that has shown a reduction, and reflects the competition of such crops as dry, edible beans under irrigation, and winter wheat on the dry land areas.

The two crops mentioned can be grown wholly mechanically, plus the fact that high prices have been obtained consistently for several years. A resume of the 1947 crop indicated that table potatoes brought almost as much as certified seed. This does not mean that certified potatoes were in disfavor, but extremely high prices for table stock were obtained throughout most of the season. This high level price for table stock made it very difficult to maintain a premium on certified seed, and consequently, approximately one-half of the certified seed crop was diverted to table stock channels.

The early crop of table stock production in the Gibbon-Kearney-Cozad section, along the Platte River, was planted the first part of April, following a late spring caused by snow and rains during March. Ground and weather conditions were unfavorable at the time, and serious rotting of seed pieces, took place. Many growers reported poor stands, some to the extent that it was practical to rework the fields and plant with another crop. Owing to the shortage of seed potatoes at that time, corn was being used for the replacement. The acreage of potatoes planted in that area is shorter than last year, and, according to present information the acreage of non-certified potatoes in western Nebraska will be slightly higher than last year.—MARX KOEHNKE.

NEW JERSEY

Excessively heavy rainfall throughout the state since planting time has caused serious fertilizer deficiencies in certain fields. The most evident deficient elements are nitrogen and magnesium. Numerous fields will produce below average yields but the crop in general is making satisfactory growth. Many growers have been prevented from cultivating or spraying because of the wet fields. This has resulted in excessive weed growth, inadequate hilling of the plants, and poor fungicidal protection which will in turn cause reduced yields, more greening of the tubers later in the season and the possible development of serious late blight infection. Many growers have resorted to dusting their fields by airplane as a means of protecting the plants from late blight and insect injury.

Late blight was found in localized sections of three widely separated fields during the last week in June, but it is not general or serious as yet. A few days of dry weather together with thorough spraying or dusting with copper should prevent these infections and prevent its spread.

Harvesting of cobblers will probably begin, in a small way, about the 12th of July.—JOHN C. CAMPBELL.

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New York

Up-state New York Growers have just about finished planting. The acreage is probably less than their goal.

The Long Island acreage reported up to allotment with the crop growing rapidly. Wet weather during the last one-half of May over the whole state retarded planting in up-state areas and also cultivation on Long Island.

New York growers are watching anxiously for developments of washing machines on the southern potatoes. One washing plant is being installed on Long Island which will be closely watched by growers in the Northeast.

Much interest is manifest on the position of potatoes in regard to current legislation. The attitude of New York growers is that 90 per cent parity was too high and that 60 per cent would be considered as good insurance and would probably produce enough potatoes.

Much interest is expressed in the grade qualifications for eligible growers in the present potato program. Although all growers agree that low grade potatoes hurt the market they are concerned about what to do with these grades in case the Government does not allow shipment. To meet the problem, a large dehydrator is installed and ready for business at Avoca which can turn out large quantities of potato meal.

One of the biggest public demonstrations of farm machinery will be staged at the Summer meeting of the Empire State Potato Club which will be held the 12th of August on the farms of J. W. Hopkins & Son and Irving N. Hopkins at Pittsford, New York, which is 10 miles South of Rochester in Monroe County and the center of an extensive farm area. These two farms grow more than 700 acres of cash crops each year including some certified grain. A full program is being arranged with the cooperation of the Department of Agricultural Engineering and the extension staff at the College. Herb Johnson of the Monroe County Farm Bureau is general chairman. This is probably the biggest meeting of this kind in the country and is looked forward to as an annual event by growers from many states besides New York.—H. J. Evans.

North Carolina

Like the other early commercial potato areas in the southeast the plantings in North Carolina were late because of adverse weather. However, the conditions were good after planting and generally the crop was superior to that of 1947 until the latter part of May. Late blight was found first in Pamlico County about the 16th of May. The weather since

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that time has been cool, with frequent rains. The spread has been fairly general over the coastal counties. The potato crop is made, but there is considerable concern over the late blight infection reaching the tubers. Some of the growers are using defoliants and rotobeaters to kill the tops before harvesting. The success of these practices and the general degree of tuber infection will depend largely on the weather during the next two weeks.

The picture is further complicated by the market situation. The North Carolina growers voted in the Marketing Agreement which took effect Friday night, the 4th of June. Under these regulations only U. S. No. 1's can be sent out of the state. The southeastern potato committee is now administering this Agreement.

The movement of potatoes thus far is approximately 1500 cars. Our yields are reported to be higher than last year and the quality good. The price has been around support level or slightly below. The reduction in acreage and yield in South Carolina have had no effect on the market situation here. This reduction is more than offset by the increase in California and by late shipments from South Carolina. In addition, Eastern North Carolina and the Eastern shore of Virginia will market much of their crops during the same period. It is generally felt that a high percentage of potatoes in this area will be moved on the support program this year.—FRED D. COCHRAN.

SOUTH DAKOTA

Early planted potatoes in South Dakota are now up and many fields have been cultivated for the first time. The stands are exceptionally good and the fields are clean since May was a very dry month with moisture far below normal. Good rains have been received at this writing, the 7th of June, and the potato crops are in excellent condition.

Applications for certification are now coming in and the acreage will be about the same as last year when 6,350 acres were entered for certification.

A meeting to nominate committee men to administer the potato marketing program will be held in Watertown, on the 14th of June. The potato marketing agreement will cover six counties in the northeastern part of the state and all potato growers in these counties have been invited to attend the meeting. R. E. Keller of Chicago will help with the elections.—JOHN NOONAN.

Virginia

By this time you have probably heard of the panic which recent cool, rainy weather has caused potato growers in North Carolina and the Norfolk section of Virginia. We have had a super-abundance of rain and the weather has remained unusually cool for this time of the year. Late blight is spreading like wildfire in many fields which were either not dusted with copper or where the copper dust was washed off by heavy rains. In addition, in certain low-lying fields, standing water has rolled the potatoes in the ground. We have heard of a few fields which are a complete loss—where it is impossible to find a sound potato left in 20 feet of row. Some pessimists estimate that in the Norfolk section nearly 25 per cent of our potential production will be lost by the blight killing vines two weeks before digging time. The situation probably is not quite that bad, but all agree that they have never seen the weather turn the best potato crop prospects in history into almost the worst,—within a period of approximately one week.

Our Norfolk section dealers and growers are fearful that the blight news concerning our potato crop will scare off many prospective buyers. They hasten to explain that there are many fields which have not been touched so far by blight. These are mostly fields where a careful and continuing program of dusting with copper was followed. They point out that the commercial trade can buy plenty of blight-free potatoes in the Norfolk section. Because of the tremendous production in late spring and early summer states, we expected to sell nearly 50 per cent of our crop to the government in Virginia anyway. Of course, Virginia growers feel that over-planting in California is the principal reason for this.

The Eastern shore of Virginia—which has about 27,000 of our 35,000 acres of early commercial potatoes—has not as yet been hit by blight as has Norfolk section. There is a little blight showing up in lower Northampton County on the shore, but now that the rains seem to have ended, this is not expected to spread. In addition, Eastern Shore growers seem to have followed a more consistent program of dusting with copper. The land on the Eastern Shore is more uniformly sandy, high, and well-drained than that on the Norfolk section also. Normally, however, yields and returns per acre on potatoes are higher in the Norfolk section than on the Eastern shore.

For that portion of our potatoes which will be harvested in good condition in the Norfolk section, we are going ahead with plans to put up the fanciest grade and pack than has ever been tried on a large commercial scale in this country.

Mr. G. W. Capp's 7 potato washers and driers which cost $15,000 apiece and Mr. J. H. Baker's one machine which cost nearly as much are set up and ready to go. A few potatoes have already been run through them. The new $250,000 packing shed at Euclid, Virginia, just south of the Virginia Beach Boulevard at Chinese Corner which houses six of Mr. Capp's seven machines is completed. Automatic conveyors are set up by all machines to load 10 and 15-pound bags directly into cars from the machines. About 65 per cent of Mr. Capp's production will be U. S. Extra No. 1's 2¼" to 3" size. All No. 1's between 1⅞" and 2¼" and all 3" will be run into another pack and probably most of them will go to the government. Mr. Capp's has some very fancy 10 and 15-pound bags which are heavy double paper with a visionette window. The capacity of his tremendous packing shed is 150 cars per day—operating on a 20-hour day which he will maintain during June and July. He can load about 50 cars at one time from his shed. His operation is a real site to behold and many out-of-state as well as state visitors have already come to see it. The Eastern Shore of Virginia has no washers and driers this year, but Mr. Capp's plans to handle many Eastern Shore potatoes later in the season.—E. W. CAKE.

CANADA

(Manitoba Section)

The Manitoba potato planting will be completed by 5th of June. The acreage is being increased by approximately 10 per cent over the 1947 plantings. The increase is mostly among the Russet, Green Mountain, Chippewa, Bliss Triumph and Warba varieties. The Irish Cobbler planting is considerably less over 1947 plantings. This is mostly due to depressed markets on cobblers because of excess hollow heart in the tubers. Our estimated total acreage will be 30,500.—H. WASYLYK.

(Ottawa Section)

At the recent sessions of the Provincial Legislature in Prince Edward Island, a bill requiring that all potato fields in the Province must be planted with certified seed only was approved. Actually this bill was passed a year ago, but it was brought up again for discussion and was endorsed. This is aimed at the control of bacterial ring rot, which is practically non-existent in this Province. The law also prohibits the importation into Prince Edward Island of potatoes from any source whatsoever without special authority from the Provincial Government.

Most of the certified seed in Canada has been sold, and in some areas a shortage has developed. The indications are that there will be an increased acreage of both seed and table stock in 1948.—J. W. SCANNELL.

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The Model PB-3 is here shown in use in potato fields. Used to destroy green immature vines it permits harvesting operations without waiting for normal maturing of vines or their elimination by killing frost.

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References by potato growers using the Model PB-3 furnished on request. They will give you their actual experience with the use of this machine.

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(Province of Ontario)

Our supplies of potatoes are expected to be sufficient until the harvesting of our new crop which begins about the 28th of June. There has been some movement of Manitoba Commercial grade to Ontario points, and also arrivals of U. S. A. grade B have recently started in very limited amounts. Prices wholesale to retail Toronto market on the 11th of June are as follows: $4.00 per 75-pound bag; 15-pound paper 75 cents; 10-pound paper mostly 60 cents; Manitoba Commercial $2.65-$3.00, few at $3.25; California 100-pound size $3.00 to $3.65. Nearly all other markets higher than Toronto have prices firm. The shortage of quota money, which is also affecting citrus imports, has placed a very definite limitation upon the import of U. S. A. potatoes.

Some counties report a slight increase in acreage of early potatoes. Growing conditions to date in most sections have been very good. In Lambton County 25-30 per cent of the crop has been damaged by heavy rains after planting.

Planting of the late crop has been considerably earlier than usual, and plants in most fields are now (June 14th) showing above ground. With a favorable length of growing season, maturity should be well advanced by harvest time, thus favoring the general appearance and cooking quality of the 1948 crop. Most counties report that the acreage of the late crop will be about the same as last year, with increases of 10 per cent in the following areas—North Simcoe, Grenville, Ontario, Renfrew, Dundas. Slight decreases are reported from South Simcoe, Thundred Bay, Manitoulin, Lennox and Addington. The general condition of the crop is good. With increased amounts of machinery available there should be more satisfactory control of insects and diseases this year by spraying and dusting.

A warning service for blight is being organized by the officials from the Department of Agriculture. It is expected that there will be press and radio releases each Monday during the most dangerous part of the season. Any symptoms or outbreaks should be reported at once to your nearest agricultural representative or to the Botany Department, Ontario Agricultural College, Guelph.

The scab control program is underway with intensive studies being made on various angles. Growers have contributed more than $600.00 to date for the program in appreciation of the $10,000 appropriation and efforts expended by the Department.

500 Bushel Clubs have been organized in an increased number of counties this year, and a Championship Award is available on the basis of yield, marketable potatoes, exhibit and cooking quality.

There continues to be an increased interest in marketing, with the latest development at Kemptville, where a group of growers recently organized to undertake co-operative storage, grading and packaging.—R. E. GOODWIN.

(Prince Edward Island)

We are now planting potatoes in Prince Edward Island, and are far behind schedule because of the extremely wet weather. It is hoped, however, that with clearing weather, planting will be completed within the next two weeks.

Planting intentions on the part of the growers seem to be an increase in the Sebago variety of seed at the expense of Irish Cobblers. This has been due to the considerably smaller yield on the Irish Cobblers than from the Sebago variety, dunring the past few years. In general, the overall acreage will be similar to that of last year.

All potatoes planted on Prince Edward Island this year are required, by law, to be certified seed or better. Growers must, however, in order to qualify for seed certification, plant Foundation or Foundation A. This use of certified seed by all growers is a measure intended to eliminate the possibility of bacterial ring dot in the Province.

All of the 1947 crop has been marketed, with a total of more than 7½ million bushels being shipped from the Province, which includes both seed and tablestock.—E. D. REID.

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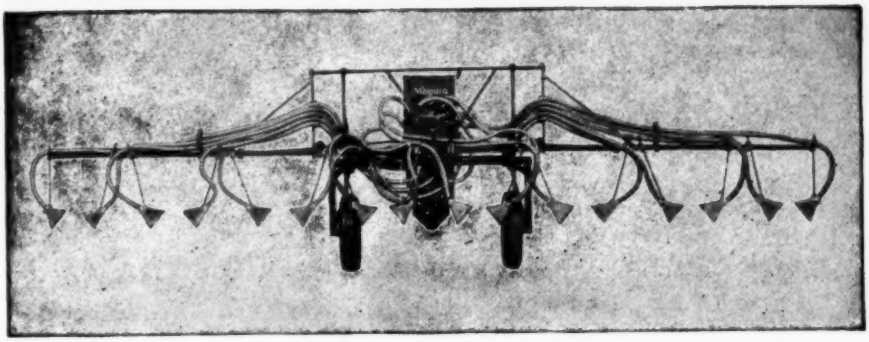

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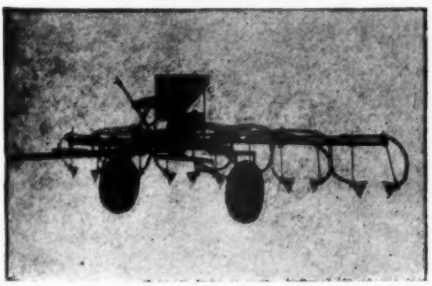

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